

KAPALAMA MILITARY RESERVATION, HRS RATIONALE
1/6/92

GROUNDWATER MIGRATION PATHWAY

1. Observed Release:

The aquifer being assessed is the shallow brackish groundwater aquifer underlying the KMR. The deep aquifer underlying the KMR is the Kalihi system of the Honolulu aquifer (Mink & Lau, 1990) which is tapped for potable purposes. The possibility of interconnection between the two exists. An observed release is established to the shallow groundwater at KMR based on the laboratory analyses of the groundwater. The following were observed:

Barium, lead (MW 7,8)
Dichloroethane (MW 5,6, 16, 17)
Ethylbenzene (MW4,11,12,13)
Petroleum Hydrocarbons (MW 4, 11, 13)

Background concentrations were not determined for any of the contaminants mentioned above, nor was the limit of detection mentioned for any of the contaminants. The maximum concentrations of all the contaminants were more than three times their minimum concentrations. Thus it can be inferred that the contaminants were more than three times above the limit of detection. The contaminants present are attributable to the sources at the site. A value of 550 is assigned for observed release to groundwater.

2. Containment:

The minimum size requirement defined in section 3.1.2.1 is met by the sources at the site. None of the sources have any liner or any other containment and so a containment value of 10 was applied (Table 3-2 HRS).

3. Net Precipitation:

Based on Figure 3-2, HRS, the net precipitation value for the Kapalama Military Reservation is 3.

4. Depth to Aquifer:

A value of 5 was assigned since the depth to groundwater is within 3 to 6 ft below ground surface (Environmental Assessment for Phase II).

5. Travel Time:

The US Soil Conservation Service describes KMR as fill land

mixed (FL). The sedimentary rocks directly under KMR have high permeability. A value of 10^{-4} cm/sec is assigned for the hydraulic conductivity (Table 3-6 HRS). Based on the hydraulic conductivity and the depth to groundwater mentioned above a travel time factor value of 35 is obtained (Table 3-7 HRS).

6. Toxicity/Mobility:

The background concentration of contaminants at the site have not been defined in the PA/SI reviews. In the absence of such data all the contaminants detected in the monitoring wells must be considered. The contaminants detected in monitoring wells include Al, Ba, Ca, Cu, Fe, K, Mg, Mn, Pb, Zn. A mobility factor value of 1 was assigned since an observed release is established by chemical analysis to the underlying groundwater (section 3.2.1.2 HRS).

Based on a toxicity of 10,000 (Ba, Pb) and a mobility of 1, the toxicity/mobility value is 10,000 (Table 3-9).

7. Hazardous Waste Quantity:

There are no accurate records indicating the amount of hazardous wastes disposed over the time the facility has been in use. However, it is safe to assume that the facility operated at a higher level of activity (i.e. handled more supplies) during the Second World War, the Korean and the Vietnam conflicts. Correspondingly, the potential and possibilities of waste discharge and accidental leakages are higher for that period. In addition there are two possible pre-construction waste disposal sites on the reservation and the extent of wastes disposed there is unknown (PA, Figure ES-1). It is reasonable to assume that these disposal sites are still having an impact on the groundwater quality.

Hazardous constituent quantity: Difficult to estimate.

Hazardous wastestream quantity: Difficult to estimate.

The volumes and areas for the different sources are calculated as follows:

a. Landfill: The landfill surface area was estimated to be 400 x 150 ft² (Weston, Preliminary Assessment, Figure ES-1, 1990). The total area of the two landfills was determined to be 120,000 ft². This corresponds to a C value of 35.29 (HRS, Table 2-5).

b. Drums: There were rusted 55 gallon drums labelled waste oil outside building 924 (Weston, 1990). It was noted in the PA that two drums seemed to contain rainwater. For twenty drums containing 50 gallons of waste oil the total value is 1,000 gallons of waste oil giving a C value of 2.00.

c. Tanks and containers: 40 Transformers were present on site at the time of the inspection. Two of these transformers were observed to be leaking. The transformers may contain PCBs. Assuming a 20 gallon volume for each transformer gives a total volume of 800 gallons which corresponds to a C value of 1.6.

d. Contaminated soil: Most of the soil contamination seems to be from TPH from the USTs. These are not covered under the purview of RCRA. There is pesticide contamination in the soil samples taken near the buildings S-917 and T-931 (E&E, 1990; SI, Table 5.2-1, Table 5.2-2), but it is difficult to estimate the volume of contaminated soil from these.

The total hazardous waste quantity factor was calculated to be $35.29 + 2 + 1.6 = 38.89$. This gives a hazardous waste quantity value of 1 (HRS, Table 2-6).

The hazardous constituent quantity is not adequately determined for the sources on site. Since none of the targets are subject to Level I or Level II concentrations and there has been no removal action on site, a value of 10 is assigned to the hazardous waste quantity factor value as stipulated in HRS, section 2.4.2.2.

8. Waste Characteristics:

The toxicity/mobility x waste quantity is 100,000 which gives a value of 18 (HRS, Table 2-7).

9. Nearest Well:

The closest drinking water wells to the sources on KMR are in the 1 - 2 mile radius (Kalihi Pumping Station). Based on the distance of sources to the nearest drinking water wells a nearest well factor value of 9 is assigned (HRS, Table 3-11).

10. Population:

Table 1 describes all drinking water wells located within 4 miles of KMR and the populations they serve.

Table 1. Drinking water wells within 4 miles of sources at KMR, average annual pumpage and population served.

Well Name	Well Numbers	Distance from sources (miles)	Average Annual Pumpage (MGD)	Population Served
Kalihi Shaft	2052-08	2.0	8.033	39,780 ¹
Moanalua	2153-07,10	2.3	3.492	17,293
Kalihi Pumping Station	1952-06, 08, 16, 19, 22	1.3	6.587	32,619
Red Hill	2254-01	3.7	4.0155	19,885
Fort Shafter	2053-10,11	1.7	0.9073	4,493
Tripler wells	2153-07,08	2.3	0.62	3,075

The Honolulu/Pearl Harbor basal aquifer is the main source of drinking water for the Honolulu population, particularly between Pearl City and Metropolitan Honolulu. The aquifers supply a blended water system that serves approximately 413,000 people from the city and county of Honolulu and the surrounding area (Ecology and Environment, 1989). The populations served by each of the different wells was obtained by taking the proportion of total annual pumpage obtained from each well and applying it to the total population served. The average total daily consumption from the Honolulu aquifer was 83.4 MGD (Lao, 1991).

A total population of 117,145 was obtained from Table 1 above. The non-Karst portion of Table 3-12 was used. The population figures were split up into distance categories based on the distance of the wells from the site. This results in a total distance weighted population value of 12,813 from Table 3-12. This value was divided by 10 resulting in a potential contamination value of 1,306.

11. Resources:

The underlying aquifer is used for irrigation of commercial food crops resulting in a resources value of 5 as stipulated in HRS, section 3.3.3.

¹These wells serve a blended water system of 83.4 MGD, including 40 MGD from the pearl Harbor aquifer and 0.5 MGD from the windward side (Lao, 1991). The water system provides drinking water for the Metropolitan Honolulu population.

12. Wellhead Protection Area:

No wellhead protection areas have been identified in Hawaii. However, a study is presently being conducted to determine wellhead protection areas by the United States Geologic Survey.

A value of 0 was assigned due to the lack of any designated wellhead protection areas applicable to the aquifer being evaluated.

SURFACE WATER/OVERLAND FLOW MIGRATION COMPONENT

13. There are no surface water streams at the site. Kapalama drainage canal discharges into the Kapalama basin at the north eastern tip of the KMR. As such surface water flow on site would be only in the storm drains. Chlorinated pesticides (DDD, DDT, chlordane) and heavy metals (arsenic, barium, chromium, lead) were detected in storm sewer sediments. The maximum concentrations of the substances mentioned above and their EPA Ambient Aquatic Life Advisory Concentrations (AALAC) for saltwater are summarized in Table 3 in the PA/SI review. An observed release can be established based on these (HRS, Section 4.1.1.1). A value of 550 is assigned to the projected score.

14. Containment for Surface Water Migration:

No containment would prevent migration of hazardous substances from any of the sources once a spill, leak or discharge occurs. A value of 10 is assigned as stipulated in HRS, section 4.1.2.1.2.1.1.

15. Runoff:

The 2-year, 24-hour Rainfall: < 4 inches (Giambelluca, 1984).
Drainage area of the site = 65.4 acres (2,853,820 ft²).
Soil group: Sand (soil group designation A - Table 4-4).

The runoff from the area would probably enter the storm drains and enter the ocean in a short while. The drainage area would be the entire area of the site, most of which is covered with asphalt. This results in a drainage area value of 2 (HRS, Table 4-6).

Using soil group designation of A and 2 year, 24 hour Rainfall value of 3.5 or greater, a rainfall/runoff value of 3 was obtained HRS, Table 4-6).

A runoff factor value of 1 was obtained by using a rainfall/runoff value of 3 and a drainage area value of 2

(HRS, Table 4-6).

16. Distance to surface water:

There are a few storm drainage sewers on the site. From the PA and SI it would appear that all the sewers are confined to the KMR and there are no storm drains from beyond the limits of the facility flowing into the KMR drains. The distance to surface water from the points of origin of the drains ranges from 600 to 2,000 ft. A value of 16 is assigned to the factor based on the lowest distance to surface water from the site (HRS, Table 4-7).

17. Flood containment:

There is no evidence of any flood containment at the sources which is designed, constructed, operated, and maintained to prevent a washout of hazardous substances by a flood. The value of 10 is assigned according to Table 4-8.

18. Flood frequency:

The location of the Kapalama Military Reservation falls in areas defined in the Flood Insurance Rate Map (115 of 135), as "Zone X: Areas determined to be outside the 500 year floodplain." A flood frequency factor value of 0 was used (HRS, Table 4-9) as applies to areas not in the floodplain.

19. Toxicity/Persistence:

The inorganic contaminants considered have toxicity of 1×10^4 .

Lead was considered for persistence because of its high value of 1. The toxicity/persistence value is 10,000 (HRS, Table 4-12).

20. No drinking water intakes exist for the surface water pathway.

21. The area around the Honolulu harbor is used for recreational purposes by people using sailboats and windsurfers. A value of 5 is assigned as stipulated in HRS, section 4.1.2.3.3.

22. Toxicity/Persistence/Bioaccumulation:

Considered for lead: Toxicity = 10,000, Persistence = 1, Bioaccumulation (human food chain, salt) = 5,000.

Toxicity/Persistence/Bioaccumulation factor value of 5×10^7 was obtained from HRS, Table 4-16.

23. Toxicity/Persistence (10,000) x Hazardous Waste Quantity (100) x Bioaccumulation (5,000) = 5×10^8 . This results in a waste characteristics factor category value of 100 (HRS, Table 2-7).

24. Food Chain Individual:

An observed release is established by the detection of lead during the chemical analysis of the sediments in the storm drains (SI, Table 5.3-2). Recreational fishing is done in the coastal waters. A value of 20 is assigned to the food chain individual factor (HRS, Section 4.1.3.3.1).

25. Potential Human Food Chain Contamination:

The majority of the fishing within the target distance limit is in an area considered deep ocean zone (>200 ft) resulting in a dilution weight of 0.000005 (HRS, Table 4-13). The fish catch data obtained from the Department of Land and Natural Resources was divided into quadrants. The portion of quadrants within the target distance limit were evaluated and the fraction of that quadrant's 10 year average fish catch was added to other quadrants to obtain a total fish catch within the target limit (15 miles). Using this method a total fish catch of 515,215 lbs was estimated resulting in an assigned human food chain value of 310 (HRS, Table 4-18). The dilution weighting factor (0.000005) times the human food chain population value (310) equals 0.00155.

Data for recreational fishing in the adjoining coastal waters is not available and is estimated to be between 100 to 1,000 lbs/yr, thus receiving a human food chain population value of 0.3 (HRS, Table 4-18). A dilution weighting factor of 0.0001 was applied for coastal waters (HRS, Table 4-13). The summation of the two fisheries is 0.00158. Divided by 10 this results in a Fisheries subject to potential contamination value of 0.000158.

26. Ecotoxicity/Persistence/Bioaccumulation: (hazardous substance reference table).

For lead: Ecotoxicity = 1,000, Persistence = 1, bioaccumulation (salt, environmental) = 5,000. Ecosystem toxicity/persistence factor value of 1,000 was obtained from HRS, Table 4-20. Ecosystem toxicity/persistence/bioaccumulation value of 5×10^6 was obtained from HRS, Table 4-21.

27. Ecotoxicity/Persistence (1,000) x Hazardous Waste Quantity (10) x Bioaccumulation (5,000) = 5×10^7 . This results in a waste characteristics factor value of 56 (HRS, Table 2-7).

28. Surface water, Environmental Threat Targets, Sensitive Environments:

Sediment samples from the storm drains at KMR have established an observed release to surface water and groundwater samples

from the monitoring wells have established an observed release to groundwater. The runoff from the same areas eventually enters the coastal waters. No surface water, benthic, or sediment samples were available within or beyond the sensitive environments considered.

Because no sampling data was available from sensitive environments nearby KMR, potential contamination was assessed for sensitive environments within the target distance limit from KMR.

Wetlands within 15 miles of the site that have portions located along the hazardous substance migration path for sources at the site include the following:

(1) a coastal wetland (reef runway) that surrounds the fringe area of the reef runway, which is a man-made, marine coastal habitat for the Federal designated endangered species, the Hawaiian stilt. The perimeter of the wetland between the golf course and the reef runway is roughly 15,200 ft, as determined by measurement of the Honolulu International Airport and Hickam Air Force Base Emergency Response Grid Map;

A surface water dilution weight of 0.0001 is applied to the reef runway wetland as applies to coastal tidal waters (table 4-13). The endangered Hawaiian stilt receives a value of 75. A wetlands rating value of 75 was assigned based on the perimeter length of the wetland (2.88 miles) (Table 4-24).

(2) Keehi Lagoon, consisting of tidal flats, shallow water, and small islands with a total area of 450 acres. The area is used by the federally endangered Hawaiian stilts for feeding and resting. The state endangered Hawaiian owl (*Asio flammeus sandwichensis*) has also been observed here. The perimeter of Keehi Lagoon is approximately 6.75 miles as estimated from a topographic map. This estimation is extremely rough as the exact boundaries of the wetland were not well defined in the Oahu Wetlands Project Document;

Keehi Lagoon is considered subject to potential contamination. The pathway to the wetland would be either by groundwater to surface water, surface water migration from the KMR through the storm drains emptying west into Keehi Lagoon

A surface water dilution weight of 0.0001 is applied to Keehi Lagoon wetland as applies to coastal tidal waters (Table 4-13).

The Hawaiian Stilt is assigned a sensitive environments rating of 75, the Hawaiian Owl is assigned 50 (Table 4-23), and, based on the perimeter length of the Keehi Lagoon, a wetland rating value of 150 is assigned for total length of 6.75

miles.

(3) Waipio Basin, has an approximate area of 454 acres is a wetland located in Pearl Harbor. It has a perimeter of approximately 2 miles, and is located about 7.2 miles from KMR. It is composed of several large and small wetlands on the Waipio Peninsula in Pearl Harbor and is partly in use for sugar cane production and The wetland is habitat for the Federally endangered Hawaiian Coot, Hawaiian Duck, Hawaiian Gallinule, and Hawaiian Stilt (Ecologically Sensitive Wetlands on Oahu, Env. Cntr., 1989).

(4) Walkers Bay is a coastal wetland located in Pearl Harbor of 26.6 acres and about 3/4 mile in length. It is about 7.0 miles from KMR. It is habitat for four federally endangered species; the Hawaiian coot, duck, gallinule, and stilt, as well as the State listed endangered species; the Hawaiian owl. A value of 350 was assigned for sensitive environments and an additional value of 25 for the wetlands length.

The following sensitive environments were combined to receive a total sensitive environment assigned value of 1650:

(5) Pearl Harbor is an estuarine environment that is being considered for listing in the National Estuary Program under section 320 Clean Water Act. Based on its potential for qualification under this program, a value of 100 is assigned for sensitive environments rating.

(6) Apokaa Pond is a 19.3 acre wetland located about 9.5 miles from KMR. The pond is habitat for the Hawaiian coot, gallinule and stilt, all listed as federally endangered species.

(7) Waikele is a 54.4 acre estuarine swamp occupying the northwest corner of Waipio Peninsula in Pearl Harbor. It is habitat for the federally listed endangered species, the Hawaiian coot, duck, gallinule, and stilt. The wetland is located 9.3 miles from KMR.

(8) Waipahu Landfill is a 17.6 acre area located along the western coast of Waipio Peninsula just south of the Waikele wetland in Pearl Harbor. It is habitat for the federally listed endangered species, the Hawaiian coot, duck, gallinule, and stilt. The wetland is located about 9.0 miles from KMR.

(9) The Honouliuli National Wildlife Refuge is a 31.2 acre area in the West Loch of Pearl Harbor. It is habitat for the federally listed endangered species, the Hawaiian coot, duck, gallinule, and stilt. The wetland is located about 9.3 miles from the site. To the north of the refuge is a series of four 1-2 acre fishponds, used for production of Malaysian prawns.

(10) The Waiawa National Wildlife Refuge is a 54.1 acre wetland consisting of a large pond located adjacent to a U.S. Navy Landfill and the Middle Loch of Pearl Harbor. It is habitat for the federally listed endangered species, the Hawaiian coot, duck, gallinule, and stilt. The wetland is located about 7.6 miles from KMR.

SURFACE WATER/GROUNDWATER TO SURFACE WATER PATHWAY

29. The groundwater to surface water pathway was not scored because of the lack of any drinking water intakes from the surface water, and the lack of sampling data. However, the pathway is subject to consideration because the conditions defined in section 4.2.1.1 are met for the KMR site in that (1) no aquifer discontinuity is established between the source and the portion of the surface water within 1 mile of the source; and (2) the top of the uppermost aquifer is at or above the bottom of the surface water.

An observed release to the uppermost shallow water aquifer at KMR has been established in a previous section. An observed release to the coastal waters is established by the detection of chromium, barium, lead and arsenic in the storm drains. These drain into the coastal waters. There is no flowing stream through the site.

SOIL EXPOSURE PATHWAY

30. An observed release to the soil pathway is established by detection of chlorinated pesticides (DDD, DDE, DDT, dieldrin 2,4-D, PCP and PCBs) and metals (arsenic, barium, lead) in the concrete floors of various buildings and the soil at different locations.

31. Toxicity:

A value of 10,000 is assigned based on the presence of lead, arsenic and barium.

32. A value of 18 is applied from Table 2-7.

33. Workers:

The PCP concentrations detected in the concrete and soil outside buildings T-929 and T-931 were above 4.9 mg/Kg, which is the dose for individual cancer risk (E & E Reference Tables). A value of 5 is assigned for workers from HRS, Table 5-4.

34. Attractiveness/Accessibility:

The sources are accessible to personnel allowed on base. It is clear that there is no recreational use of the area. A value of 10 is assigned for "Accessible, with no public recreation use" (Table 5-6).

35. Area of Contamination:

An observed release into the soil has been established but the area of contamination is not known. The area of contamination was estimated based on the information given in the SI. The soil up to 5 ft outside buildings T-917, T-921, T-924, and T-931 and around the concrete pad were combined to give the area of contamination. A value of 20 is obtained from Table 5-7 for the area of contamination factor value.

36. Likelihood of Exposure:

A likelihood of exposure value of 5 is applied from Table 5-8.

37. Nearby Individual:

The travel distance from any place of residence to KMR is over 1/4 mile so a nearby individual factor value of 0 is assigned (Table 5-9).

38. Population within 1 mile:

As of 1991, 83 civilian personnel (44 exchange, 39 others) work at the KMR.

All travel distances to the sources from the permanent workplaces on-base are from 0 to 1/4 mile. A total of 78 workers are within the 0 to 1/4 mile travel distances from the source. Estimates of the population within 1 mile were obtained from the 1990 Census Data, resulting in a distance weighted population value of 99 (Table 5-10). Divided by 10, a total nearby population threat factor value of 9.9 is assigned.

AIR PATHWAY

39. Observed Release

No observed release at KMR could be established by chemical analysis due to the lack of any analytical data on the air samples. The release of volatile hazardous substances like solvents can be inferred by the nature of activities carried out at the base for the last 40 years. Contaminants could have evaporated during storage and during accidental spills, of which there are no records, but which would almost certainly have occurred statistically. However, no adverse

effects associated with any release have been documented. Based on the information, an observed release to air cannot be established.

40. Gas Potential to Release:

Chlordane, pentachlorophenol, and DDE were evaluated for gas potential to release.

Gas containment factor value of 10 is assigned to the sources on site (Table 6-3).

Source type factor value of 19 is assigned for contaminated soil (Table 6-4).

A gas migration potential value is determined considering air gas migration values for Pentachlorophenol (6), DDE (6) and Chlordane (6), resulting in an average of 6, thus receiving an assigned value of 6 (Table 6-7).

A total gas source value of 250 is assigned for the gas potential to release.

41. Particulate Potential to Release:

Particulate containment: A value of 10 is assigned (Table 6-9).

A particulate source type value of 22 is assigned (Table 6-4).

Particulate migration potential was determined to be 17 (Figure 6-2).

A particulate source value of 390 was obtained

42. Toxicity/Mobility:

A toxicity value of 10,000 was chosen as applies to chlordane.

A mobility value of 1 is assigned for chlordane.

A toxicity/mobility value of 10,000 is assigned (Table 6-13).

43. A value of 20 was assigned to the nearest individual factor based on the distance to nearest individual from 0-1/8 mile (Table 6-16).

44. Population, Potential Contamination:

Estimates of residents and workers regularly present on-base within target limit was based on the facility map showing building locations and on the total worker population (83

people). Estimates for population beyond the facility boundary were based on 1990 Census Data.

A total distance weighted population value of 1015 was determined. This resulted in a potential contamination value of 101.5

45. Resources:

A value of 5 is assigned due to the presence of a beach recreational area within 1/2 mile of the site.

46. Sensitive Environments, Potential Contamination: within 4 miles

All wetland information is from the document, Ecologically Sensitive Wetlands on O'ahu (Miller et al., 1989).

1. Fort Kam: Coastal wetland occupies about 1.25 miles along the coastline with a total area of about 67.4 acres. It is located about 3.5 miles from the site. It is adjoined by the reef runway to the south and the Hickam golf course to the north. The southernmost portion of the wetland habitat runs parallel to the reef runway. No endangered species are known to use this habitat.
2. Reef Runway: A 792 acre coastal wetland that surrounds the fringe area of the reef runway, which is a man-made, marine coastal habitat for the federally designated endangered species, the Hawaiian Stilt. The perimeter of the wetland between the wetland and the golf course is roughly 15,200 ft, as determined by the determination of the Honolulu International Airport and the HAFB Emergency Response Grid map. The reef runway is situated about 3 miles from the site;
3. Keehi Lagoon: Keehi Lagoon, consisting of tidal flats, shallow water, and small islands has a total area of 450 acres. It is located about 3,000 ft from the sources on the site. The area is used by the federally endangered Hawaiian Stilts for feeding and resting. The state endangered Hawaiian Owl (*Asio flammeus sandwichensis*) has also been observed here. The perimeter of Keehi Lagoon is approximately 6.75 miles as estimated from a topographic map. This is a rough estimation as the exact boundaries of the wetland have not been well

defined in the Oahu Wetlands Project Document.

A sensitive environments factor value of 0.74275 was assigned as stipulated in HRS, section 6.3.4.3.